



# New and noteworthy snake species records (Colubridae and Dipsadidae) for the Reserva Natural Laguna Blanca, eastern Paraguay

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**Abstract:** We update a species list of reptile diversity at the Reserva Natural Laguna Blanca, with four additional species of snakes, *Drymarchon corais* Boie, 1827, *Dipsas cisticeps* (Boettger, 1885), *Oxyrhopus rhombifer rhombifer* Duméril, Bibron & Duméril, 1854, and *Phimophis guerini* (Duméril, Bibron & Duméril, 1854). This additional data qualifies San Pedro department as the most diverse department in Paraguay for reptiles. We build upon the already strong case for the reserve, which had its official protection lapse after five years, to be redeclared as a protected area and recognised as an “Important Area for the Conservation of Amphibians and Reptiles”.

**Key words:** *Dipsas cisticeps*; *Drymarchon corais*; *Oxyrhopus rhombifer rhombifer*; *Phimophis guerini*; *Rhachidelus brazili*

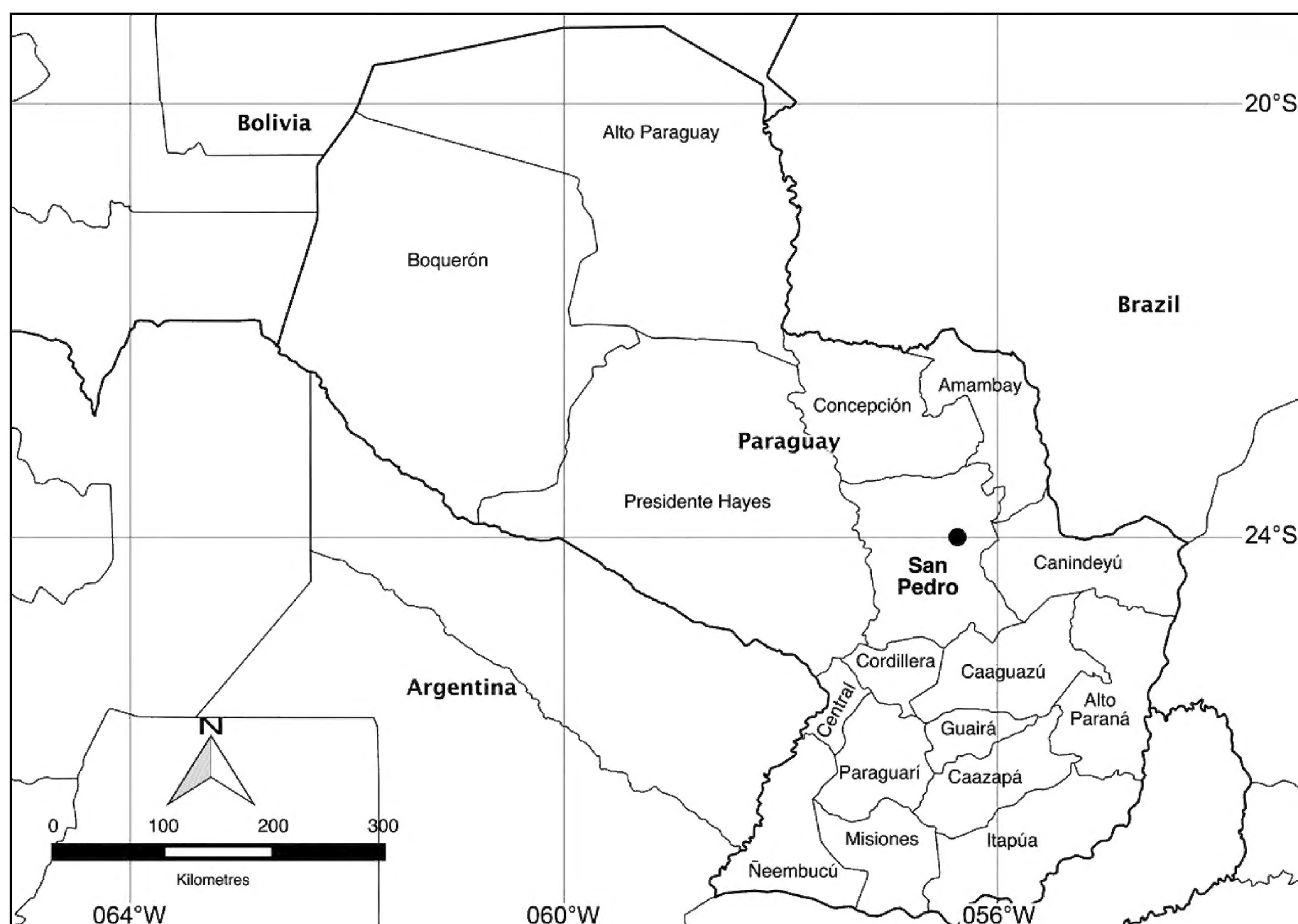
Cacciali et al. (2016) reviewed reptile species richness in Paraguay and provided data on more than 180 species. The reptile fauna of the Reserva Natural Laguna Blanca\* (RNLB), San Pedro department, Paraguay, is composed of a high number of species (57) compared to other Paraguayan localities and includes an impressive number of globally and nationally threatened taxa. This locality was inventoried by Smith et al. (2016) who categorized it as an “Important Area for the Conservation of Amphibians and Reptiles”. Though the inventory was considered to be essentially complete by mid-2014, limited sampling continued and, remarkably, additional species were added to the list. These additions came too late to be included in the original manuscript and are thus documented here with the aim of updating available data on species richness at the RNLB.

\* Although no longer officially protected as a natural reserve, the name in use between 2010 and 2015 is utilized here.

The Reserva Natural Laguna Blanca (23°48' S, 056°17' W) (Figure 1) is comprised of 804 ha of mosaic habitat, which consists of 400 ha of near-pristine Cerrado, and a 400 ha patch of degraded Atlantic Forest, with areas of transitional semi-deciduous, semi-humid forest. The four main Cerrado ecotopes (campo limpio, sensu strictu, campo sucio and cerradón) are present at RNLB and grow on a predominately sandy substrate (Eiten 1972, 1978). The RNLB was declared a Natural Reserve on 3 February 2010 for just five years (Decreto 3893 under Artículo 26 of Protected Areas Law 352/94), but this official protection expired and was not renewed in February 2015.

Representatives of Fundación Para La Tierra, a not-for-profit organization based at RNLB, sampled the herpetofauna between November 2014 and October 2015. A variety of methods were used including pitfall trapping with drift fence, active searching (day and night), incidental observation, refuge provision, and collection of dead individuals. Pitfall traps were constructed using lines of ten 30-L buckets, separated by 5-m-long drift fences, which stood 0.5 m off the ground. Active searching mostly took place between dusk and midnight, or early in the morning. Refuge provision consisted of placing metal sheets (1 m<sup>2</sup>; painted to avoid overheating) on the ground at random in various places across the reserve. Sampling was not standardized due to irregular availability of man hours and resources.

Voucher specimens were dispatched humanely according to Simmons (2002) and preserved in the Colección Científica de Para La Tierra (CZPLT) registered by the Secretaria del Ambiente (SEAM), and housed at RNLB. All specimens were collected under permits 21/14 and 110/2015 issued by the SEAM. Identifications used external morphological characters such as coloration, measurements (in mm), and scale counts, including dorsals (recording reduction), ventrals (following Dowling



**Figure 1.** Map showing the location of the Reserva Natural Laguna Blanca (black dot), San Pedro department, Paraguay.

1951), and subcaudals. Measurements include snout-vent length (SVL) and tail length (TL).

We report here four additional species of snakes new to RNLB: *Drymarchon corais* Boie, 1827, *Dipsas cisticeps* (Boettger, 1885), *Oxyrhopus rhombifer rhombifer* Duméril, Bibron & Duméril, 1854, and *Phimophis guerini* (Duméril, Bibron & Duméril, 1854). Three of these are also new records for San Pedro department. An additional specimen of the rare snake *Rhachidelus brazili* Boulenger, 1908 is also documented.

#### Colubridae

##### ***Drymarchon corais*** (Boie, 1827): Figure 2

CZPLT-H 946 (SVL: 1523 mm; TL: 330 mm; dorsals: 17-17-15 (smooth); ventrals: 205; anal single; subcaudals: 77). A female was collected on 29 October 2015 by Alexander Matthews, in an area of disturbed cerradón habitat near Para La Tierra's headquarters. *Drymarchon corais* is present throughout the Americas from Texas to northern Argentina and Paraguay (Cacciali et al. 2016). In Paraguay this species occurs in Alto Paraguay, Amambay, Boquerón, Concepción, Presidente Hayes, and San Pedro departments. The only other record from San Pedro department is from Colonia Primavera, with two specimens housed at the British Museum (Cacciali et al. 2016). In Paraguay, this species is considered Least Concern (Motte et al. 2009).

#### Dipsadidae

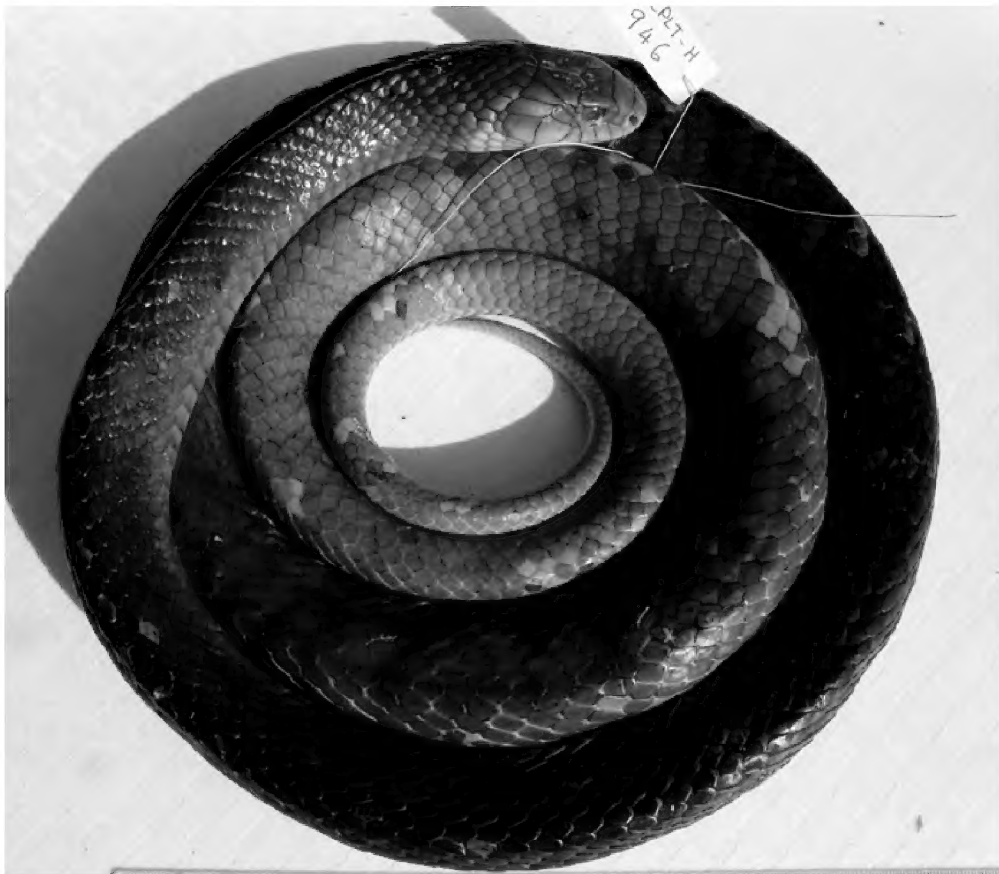
##### ***Dipsas cisticeps*** (Boettger, 1885): Figure 3

CZPLT-H 866 (SVL: 613 mm; TL: 220 mm; dorsals: 13-13-13; ventrals: 184; subcaudals: 88). Collected on 23 September 2015 by Alexander Matthews in Atlantic Forest near to a flooded pond, and identified based on the key in Cacciali (2006). The species occurs in forested areas in eastern Bolivia, northern Argentina, and eastern Paraguay (Alto Paraná, Canindeyú, Misiones, and Itapúa departments). All previous reports of Paraguayan specimens are from Atlantic Forest and Mesopotamian Grassland ecoregions (Cacciali et al. 2016). Thus, this is the first record for San Pedro department and the Paraguayan Cerrado zone. The species is poorly known, scarce in collections, and in Paraguay is considered Data Deficient (Motte et al. 2009).

##### ***Rhachidelus brazili*** Boulenger, 1908: Figure 4

CZPLT-H 890 (SVL: 731 mm; TL: 160 mm; dorsals: 27-25-21; ventrals: 189; subcaudals: 71). Collected by Alexander Matthews on 7 October 2015 in the Cerrado at RNLB. This rarely recorded species is known from southern Brazil, eastern Paraguay, and northeastern Argentina (Smith et al. 2013). While this species has been previously recorded 10 km from RNLB, this is the first record from inside the reserve, and only the third record for the country (Smith et al. 2013). All Paraguayan records are





**Figure 2.** *Drymarchon corais* (CZPLT-H 946). Photograph by Karina Atkinson.



**Figure 3.** *Dipsas cisticeps* (CZPLT-H 866). Photograph by Alexander Matthews.

from San Pedro department. This species is considered Critically Endangered nationally (Motte et al. 2009, Smith et al. 2013).

***Oxyrhopus rhombifer rhombifer*** Duméril, Bibron & Duméril, 1854: Figure 5

CZPLT-H 844 (SVL: 487 mm; TL: 55 mm; dorsals: 19-19-17; ventrals: 181; subcaudals: 56). A dead specimen was collected on 9 June 2015 by Jorge Ayala, in sandy soil on the edge of a eucalyptus plantation. The specimen had recently consumed a small rodent (CZPLT-M 461). *Oxyrhopus rhombifer rhombifer* is known in Paraguay from a single specimen collected in the Mesopotamian grasslands of Itapúa department (Cacciali et al. 2016). This is the first record for San Pedro department and the Paraguayan Cerrado, although it is known to occur in Cerrado in neighboring Brazil (Cacciali et al. 2016). *Oxyrhopus rhombifer* is considered Least Concern nationally



**Figure 4.** *Rhachidelus brazili* (CZPLT-H 890). Photograph by Alexander Matthews.

(Motte et al. 2009) but this subspecies, which inhabits eastern Paraguay, is rarely encountered.

***Phimophis guerini*** (Duméril, Bibron & Duméril, 1854): Figure 6

CZPLT-H 882 (SVL: 699 mm; TL: 135 mm; dorsals: 19-19-17; ventrals: 213; subcaudals: 66). Collected on 5 October 2015 by Alexander Matthews in an area of campo sucio at RNLB. Recorded in central Brazil, northern Argentina, and Paraguay, east of the Paraguay River (Central, Concepción, Misiones, and Paraguari departments). This is the first record from San Pedro department. The species is considered Data Deficient in Paraguay (Motte et al. 2009).

The addition of these four species to the inventory of the RNLB brings the total to 61 reptile species recorded within this small property. While these records do not significantly increase the ranges of any of the species, the result demonstrates how under sampled the Paraguayan fauna remains and highlights the urgent need for long-term inventorying in other Paraguayan departments.

The RNLB reptile list represents 33.0% of the 185 reptile species known to occur in Paraguay and 69.3% of the 88 reptile species found in San Pedro department (Cacciali et al. 2016; Smith et al. 2016). Of the species known to occur in San Pedro department, 29.5% of them (26 species) were first recorded by Para La Tierra field workers since the RNLB inventory began in 2010. As a result, San Pedro is now the most species-rich department in Paraguay for reptiles (Table 1). Prior to the work of Para La Tierra, San Pedro ranked sixth among departments in the country for species richness with 62 species.

Two of the species added here are considered Data Deficient. Smith et al. (2016) reported that Motte et al. (2009) considered nine of the reptile species recorded at RNLB to be Data Deficient, but recommended the downgrading of five of these to Least Concern based on new data. Consequently only six reptile species occurring at





**Figure 5.** *Oxyrophus rhombifer rhombifer* (CZPLT-H 844). Photograph by Darren Graham.

RNLB can now be considered Data Deficient nationally.

Smith et al. (2016) listed 12 globally threatened species for RNLB, including six Vulnerable, one Endangered and five Critically Endangered species. Furthermore, with the description of the recently described *Tropidurus lagunablanca* Carvalho, 2016 (referred to as *Tropidurus* cf. *xanthochilus* by Smith et al. [2016]), 13 species of conservation concern are now known to occur on the property. This represents 21.3% of the total number of species. More importantly, Carvalho (2016) considered *T. lagunablanca* to be globally Critically Endangered and endemic to the property, meaning that land-use changes to the property could potentially result in the extinction of this unique and attractive species. If the case for the long-term protection of the RNLB was strong before, then it should now, without doubt, be the national conservation priority.

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**Figure 6.** *Phimophis guerini* (CZPLT-H 882). Photograph by Alexander Matthews.

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LITERATURE CITED

Cacciali, P. 2006. Las serpientes caracolas (Colubridae: Dipsadini) de Paraguay. *Revista Española de Herpetología* 20: 71–86.

Cacciali, P., N.J. Scott, A.L. Aquino Ortiz, L. Fitzgerald and P. Smith. 2016. Annotated taxonomic and distributional checklist of the reptiles of Paraguay. *Special Publication of Museum of Southwestern Biology* 11: 1–373.

Carvalho, A.L.G. 2016. Three new species of the *Tropidurus spinulosus* group (Squamata: Tropiduridae) from eastern Paraguay. *American Museum Novitates* 3853: 1–44. doi: 10.1206/3853.1

Dowling, H. 1951. A proposed standard system of counting ventrals

**Table 1.** Number of reptile species recorded in each department in Paraguay and percentage of the national reptile list represented in each, including data in this paper.

Department	No. of sp. recorded	Rank	% of national list
Alto Paraguay	65	5	35.1%
Alto Parana	57	9	30.8%
Amambay	61	6 (tied)	33.0%
Boquerón	61	6 (tied)	33.0%
Caaguazú	28	15	15.1%
Caazapá	18	17	9.7%
Canindeyú	44	10	23.8%
Central	85	2	45.9%
Concepción	58	8	31.3%
Cordillera	39	13	21.1%
Guairá	21	16	11.4%
Itapúa	72	3	38.9%
Misiones	29	14	15.7%
Ñeembucú	43	11	23.2%
Paraguarí	42	12	22.7%
Presidente Hayes	70	4	37.8%
San Pedro	88	1	47.6%

- in snakes. *British Journal of Herpetology* 1: 97–99.
- Eiten, G. 1972. The cerrado vegetation of Brazil. *Botanical Review* 38(2): 201–341. doi: 10.1007/BF02859158
- Eiten, G. 1978. Delimitation of the cerrado concept. *Vegetatio* 36(3): 169–178. doi: 10.1007/BF02342599
- Motte M., K. Nuñez, P. Cacciali, F. Brusquetti, N. Scott and A. L. Aquino. 2009. Categorización del estado de conservación de los anfibios y reptiles de Paraguay. *Cuadernos de Herpetología* 23(1): 5–18.
- Simmons, J.E. 2002. Herpetological collecting and collections management, revised edition. *Herpetological Circulars*, 31. Salt Lake City: Society for the Study of Amphibians and Reptiles. 153 pp.
- Smith, P., N. Scott, P. Cacciali and K. Atkinson. 2013. *Rhachidelus brazili* (Squamata: Serpentes): first records from Paraguay and clarification of the correct spelling of the generic name. *Salamandra* 49(1): 56–58.
- Smith, P., K. Atkinson, J.P. Brouard and H. Pheasey. 2016. Reserva Natural Laguna Blanca, Departamento San Pedro: Paraguay's first important area for the conservation of amphibians and reptiles? *Russian Journal of Herpetology* 23(1): 25–34.
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